PCT/EP2004/004501

12 07 2004

INVESTOR IN PEOPLE

The Patent Office
Concept House
Cardiff Road
Newport
South Wales
NP10 8QQ

PRIORITY DOCUMENT
28 JUL 2004
WIPO PCT

I, the undersigned, being an officer duly authorised in accordance with Section 74(1) and (4) of the Deregulation & Contracting Out Act 1994, to sign and issue certificates on behalf of the Comptroller-General, hereby certify that annexed hereto is a true copy of the documents as originally filed in connection with the patent application identified therein.

In accordance with the Patents (Companies Re-registration) Rules 1982, if a company named in this certificate and any accompanying documents has re-registered under the Companies Act 1980 with the same name as that with which it was registered immediately before re-registration save for the substitution as, or inclusion as, the last part of the name of the words "public limited company" or their equivalents in Welsh, references to the name of the company in this certificate and any accompanying documents shall be treated as references to the name with which it is so re-registered.

In accordance with the rules, the words "public limited company" may be replaced by p.l.c., plc, P.L.C. or PLC.

Re-registration under the Companies Act does not constitute a new legal entity but merely subjects the company to certain additional company law rules.

Signed Andrew Gersey

Dated 22 April 2004

PRIORITY DOCUMENT
SUBMITTED OR TRANSMITTED IN COMPLIANCE WITH RULE 17.1(a) OR (b)

Patents Form 1/77

Patents Act 1977
(Rule 16)

The Patent Office

1/77

29APR03 E803403-1 002029
P01/7700 0.00-0309705.2

THE PATENT OFFICE
G
28 APR 2003
LONDON

Request for grant of a patent

(See the notes on the back of this form. You can also get an explanatory leaflet from the Patent Office to help you fill in this form)

The Patent Office
Cardiff Road
Newport
Gwent NP9 1RH

1. Your reference — RFW/ND/VB60233P

2. Patent application number
(The Patent Office will fill in his part) — 0309705.2

3. Full name, address and postcode of the or of each applicant *(underline all surnames)*

GlaxoSmithKline Biologicals s.a.
Rue de l'Institut 89, B-1330 Rixensart, ; Belgium

Patents ADP number *(if you know it)* 8101271001

If the applicant is a corporate body, give the country/state of its incorporation — Belgian

4. Title of the invention — Novel Device

5. Name of your agent *(if you have one)* — Corporate Intellectual Property

"Address for service" in the United Kingdom to which all correspondence should be sent *(including the postcode)*

GlaxoSmithKline
Corporate Intellectual Property (CN9 25.1)
980 Great West Road
BRENTFORD
Middlesex TW8 9GS

Patents ADP number *(if you know it)* 8072555006

6. If you are declaring priority from one or more earlier patent applications, give the country and the date of filing of the or each of these earlier applications and *(if you know it)* the or each application number

Country	Priority application number *(if you know it)*	Date of filing *(day / month / year)*

7. If this application is divided or otherwise derived from an earlier UK application, give the number and the filing date of the earlier application

Number of earlier application	Date of filing *(day / month / year)*

8. Is a statement of inventorship and of right to grant of a patent required in support of this request? *(Answer yes if:*

a) any applicant named in part 3 is not an inventor, or
b) there is an inventor who is named as an applicant, or
c) any named applicant is a corporate body
See note (d)

Patents Form 1/77

9. Enter the number of sheets for any of the following items you are filing with this form. Do not count copies of the same document

Continuation sheets of this form	
Description	8
Claim(s)	4
Abstract	
Drawings	2 only

10. If you are also filing any of the following, state how many against each item.

Priority Documents	
Translations of priority documents	
Statement of inventorship and right to grant of a patent *(Patents Form 7/77)*	
Request for preliminary examination and search *(Patents Form 9/77)*	
Request for substantive examination *(Patents Form 10/77)*	
Any other documents *(please specify)*	

11. We request the grant of a patent on the basis of this application

Signature R F Walker Date 28-Apr-03

12. Name and daytime telephone number of person to contact in the United Kingdom: R F Walker 020 80474485

Warning

After an application for a Patent has beeen filed, the Comptroller of the Patent Office will consider whether publication or communication of the invention should be prohibited or restricted under Section 22 of the Patents Act 1977. You will be informed if it is necessary to prohibit or restrict your invention in this way. Furthermore, if you live in the United Kingdom, Section 23 of the Patents Act 1977 stops you from applying for a patent abroad without first getting written permission unless an application has been filed at least six weeks beforehand in the United Kingdom for a patent for the same invention and either no direction prohibiting publication or communication has been given, or any such direction has been revoked.

Notes

a) If you need help to fill in this form or you have any questions, please contact the Patent Office on 0645 500505
b) Write your answers in capital letters using black ink or you may type them.
c) If there is not enough space for all relevant details on any part of this form, please continue on a separate sheet of paper and write "see continuation sheet" in the relevant part(s). Any continuation sheet should be attached to this form.
d) If you have answered 'Yes' Patents Form 7/77 will need to be filed.
f) For details of the fee and ways to pay please contact the Patent Office.

Novel Device

This invention relates to a novel device being a hollow needle with a pointed end and side orifices, particularly to such needles for use in filling pharmaceutical vials which have an elastomeric closure which can be punctured by the needle point and fluid medicament content thereby introduced into the vial.

Such a process is known from US-A-2002/0023409 in which the residual puncture site left by the needle is heat sealed using a laser beam.

Needles for this purpose are known, but a problem with such needles is that of achieving an optimised flow pattern of the fluid as it exits the needle when within the vial. A further problem is that the point and side orifices of known needles can cut through the vial closure during puncture in a way which forms particles of the closure material which can contaminate the medicament introduced into the vial or block or obstruct flow through the needle.

There are numerous disclosures of hollow, pointed ended needles having side orifices for the exit of fluid. For example US-A-5848996, US-A-5254106, US-A-5478328, US-A-6261272, US-A-6280424, US-A-4413993, US-A-4838877, US-A-5449351, US-A-5752942, US-A-5817074, US-A-6221056, JP-A-2000140106 and SU-A-1724259. US-A-6346095 and US-A-20010012926 disclose needles in which the side orifices are profiled to direct a fluid flowing along the bore of the needle and out through the orifices back wards.

It is an object of this invention to provide an improved hollow needle addressing these problems among others. Other objects and advantages of this invention will become apparent from the following description.

According to this invention a hollow needle suitable for passing through a puncturable closure of a container is provided, comprising a tubular conduit defined by a side wall and having an internal bore for the flow of a fluid along the bore in an upstream to downstream direction, the conduit terminating externally at a pointed end, the bore terminating internally at a closed end, at least one orifice through the side wall for the exit of fluid flowing along the bore,

wherein at least one orifice has a perimeter surface through the side wall converging toward the upstream direction so as to direct a flow of fluid passing

through the orifice from the bore toward the outside of the needle in a direction which has a component in the downstream direction.

Herein the term "downstream" refers to the general direction between the end of the needle into which fluid is introduced and the pointed end, and "upstream" refers to the opposite direction.

The benefit of such an alignment of the perimeter surfaces of the bore is that fluid exiting through the orifice is thereby directed in the downstream direction, rather than exiting substantially perpendicularly to the downstream direction.

Preferably the conduit is cylindrical and there are two orifices with their centres 180° apart i.e. on opposite sides of a diameter of the conduit.

Preferably the orifice(s) is(are) elongate in the longitudinal direction of the conduit, for example being oval.

Preferably the total cross sectional area of the one or more orifice is substantially the same +/- 20% of the cross sectional area of the bore of the conduit so that flow of fluid out through the orifice(s) from the bore is not restricted.

Preferably the orifice has an upstream perimeter surface through the side wall inclined to converge toward the upstream direction. Preferably the orifice has a downstream perimeter surface through the side wall inclined to converge toward the upstream direction. If both upstream and downstream perimeter surfaces are inclined to converge with the upstream direction they may incline parallel to each other. Preferably the angle of convergence toward the upstream direction of the upstream and if present downstream perimeter surface of the orifice is at an angle of 10-60°, more preferably ca. 30°, with the upstream direction.

Preferably the perimeter of the orifice is rounded rather than sharp to reduce the possibility of cutting of the closure by sharp edges of the orifices as they pass through an elastomer vial closure, and the consequent formation of particles of the closure material.

Preferably the internal closed end of the bore comprises surfaces that converge toward the upstream direction.

Preferably these surfaces converge toward the upstream direction in the form of an edge with its ridge pointing in the upstream direction, being more preferably a sharp knife edge between the surfaces of the closed end. Preferably the angle of

convergence is the same as that of one or more of the converging perimeter surfaces of the orifice.

Preferably if there are two orifices the edge formed by these converging surfaces of the internal closed end of the bore is aligned with the line of its ridge perpendicular to the axis between the two orifices. The sloping alignment of these surfaces of the edge is preferably the same as that of the upstream perimeter surface of the orifice; i.e. at the angles disclosed above, and preferably merges smoothly with the perimeter of the orifice.

Preferably the converging surfaces of the internal closed end of the bore; e.g. the ridge of a so-formed edge, extend in the upstream direction at least as far as the upstream perimeter of the orifice. The edge is preferably part of a so called "saddle" shaped surface.

The advantage of such converging internal surfaces, particularly this edge is that flow of fluid exiting from the orifice is guided thereby in the downstream direction, and such an edge, e.g. in the form of a saddle shaped surface provides no flat surface for particles or other contamination to rest upon.

Preferably the pointed end is a pyramid with three faces. Preferably the apex of the pyramid encloses an angle of 30-60°. The benefit of a pyramid shape is that the ridges between the faces of the pyramid provide sharp cutting edges to cut through the material of a closure, and form less particles of the closure material as they cut through the closure.

Therefore a specific preferred form of the needle of this invention comprises:

a cylindrical tubular conduit defined by a side wall and having an internal bore for the flow of a fluid along the bore in an upstream to downstream direction, the conduit terminating externally at a pointed end, the bore terminating internally at a closed end, at least one orifice through the side wall for the exit of fluid flowing along the bore,

wherein at least one orifice has upstream and downstream perimeter surfaces through the side wall converging toward the upstream direction at an angle between 10-60° relative to the upstream direction,

the total cross sectional area of the one or more orifice is +/- 20% of the cross sectional area of the bore of the conduit,

and the internal closed end of the bore comprises surfaces that converge toward the upstream direction.

Preferably the pointed end of the conduit is provided as a separate plug part which can be plugged into the downstream open end of the conduit. Such a plug part may consequently comprise a male plug end which can be inserted into the open downstream end of the bore of a tubular conduit, the plug part having a pointed end longitudinally opposite this male plug end, the plug end being shaped into the above-described edge. Such a plug end may be welded into the bore of the conduit.

The conduit may also be provided externally with one or more vent groove to allow the atmosphere within a container such as a vial to escape as fluid is introduced into the container.

The above-mentioned guiding of the flow of fluid exiting from the bore into the downstream direction has a further advantage in reducing the possibility of such fluid being sprayed in the upstream direction and entering such a groove.

The conduit and plug part as described above may be made of metals such as stainless steel as commonly used in the art. Typically the conduit may have an outside diameter ca. 2-3 mm, and the bore may have an internal diameter 1-2 mm, with a side wall thickness typically 0.3-0.5 mm.

In another aspect the invention provides a process for making a hollow needle as described above comprising the steps of:

(1) providing a tubular conduit defined by a side wall and having an internal bore for the flow of a fluid along the bore in an upstream to downstream direction, the bore having an open end;

(2) providing a plug part for the open end, the plug part having a longitudinal axis and being adapted to longitudinally mate with the open end of the bore and having an end surface and an opposite end,

(3) mating the plug part longitudinally with the bore,

(4) cutting at least one orifice through the side wall in a direction converging toward the upstream direction and forming the end surface of the plug part into side surfaces that converge toward the upstream direction,

(5) before or after any of steps (1) to (4) forming the opposite end of the plug part into a point.

Preferably prior to step (3) the end surface of the plug part is formed e.g. cut into the shape of a valley with its bottom extending across the end surface perpendicular to the longitudinal direction, preferably a "V" or "U" sectioned valley.

In step (4) the orifice is cut e.g. by drilling from a direction parallel to the line of the bottom of the valley. Cutting in this preferred way can form the above mentioned saddle shaped closed end surface of the bore.

Preferred features of the so-made needle are as disclosed above.

For example in step (3) the plug part may be welded e.g. laser welded to the conduit side wall when in place in the bore. Preferably after being made as described above the outer surface of the needle is polished, e.g. electropolished, to remove burrs but not to produce a surface that is so smooth that there is high friction between the needle and a vial closure which it punctures.

In another aspect the invention provides a process for introducing a fluid into a puncturable container comprising the steps of;

(1) inserting the point of a needle as described above into the interior of the container by puncturing the container,

(2) flowing a fluid along the bore of the needle in the upstream to downstream direction,

(3) causing the fluid to exit the needle through the one or more orifice and thereby enter the container, then

(4) withdrawing the needle from the container.

For example the container may be a pharmaceutical vial having a punctirable closure and the fluid may be a liquid medicament.

The invention will now be described by way of example only with reference to the accompanying drawings.

Fig. 1 shows a longitudinal section through the pointed end of a needle of this invention.

Fig. 2 shows sequentially a process for making the needle of Fig. 1.

Referring to Fig. 1 the end of a needle 10 (overall) adjacent to the point 11 is shown. Needle 10 comprises a cylindrical tubular conduit 12 made of stainless steel of circular section of outside diameter 2.4mm defined by a side wall 13 and having an internal circular sectioned bore 14 of inside diameter 1.65 mm, the thickness of the side wall 13 being 0.38 mm. The conduit 12 is suitable for the flow of a fluid (not shown) along the bore 14 in an upstream to downstream direction indicated by the arrow.

Externally the conduit terminates externally at pointed end 11, which is in shape a pyramid with three faces, the apex of the pyramidal point 11 enclosing an angle of ca. 45°. Between the faces of the pyramidal point 11 are sharp cutting edges.

There are two orifices 15 through the side wall 13 for the exit of fluid flowing along the bore 14. These orifices are located 180° apart, i.e. diametrically opposite each other on opposite sides of the bore 14. Each orifice 15 is of an oval shape elongated parallel to the upstream-downstream direction. Each of the orifices 15 has an upstream perimeter surface 15A and also a downstream perimeter surface 15B through the side wall 13 converging toward the upstream direction at an angle (A) of ca. 30° with the upstream direction, i.e. parallel to the upstream surface 15A.

The edge 15C of the upstream perimeter surface 15A is rounded to reduce any possibility of the edge 15C cutting material of a closure through which the needle is passed. The total cross sectional area of the two orifices 15, i.e. at the extrapolated inner surface of the bore 14 is substantially the same as the cross sectional area of the bore 14.

The bore 14 terminates at a closed end 16 which is profiled. This closed end 16 of the bore comprises surfaces 17 that converge toward the upstream direction, and which meet at a sharp knife edge ridge 18. The orientation of the line of the edge 18 is perpendicular to the axis between the two orifices 15, i.e. aligned with a diameter at 90° to the diameter on which are located the orifices 15. The sloping

surfaces 17 consequently are intersected by the same diameter that passes through the orifices 15. As is seen in Fig.1 the sloping alignment of the side surfaces 17 of the edge 18 is the same as that of the downstream perimeter surfaces 15B of the orifices 15 so that the surfaces 17 merge smoothly with the perimeter surface 15B of the orifice 15. The edge 18 extends in the upstream direction beyond the upstream perimeter 15A of the orifice.

The pointed end 11 is provided as a separate plug part 20 which can be plugged into the downstream open end 21 of the bore. Plug part 20 comprises a male plug end 22 which can be inserted into the open downstream end 21 of the bore 14 of the tubular conduit 12 and has an opposite pointed end part 23 comprising the point 11, the plug end 22 being shaped into the above-described edge 18 with its sloping side surfaces 17.

The conduit 12 is also provided externally with two diametrically opposite vent grooves 24, each ca. 0.2mm deep, visible in Fig. 2.

It will be apparent that fluid flowing along bore 14 will be directed into a direction having a component in the doenstream direction upon exiting through the orifices 15, because of the directing effect of the fluid guide surfaces 15A, 15B, 17.

Referring to Fig. 2 a process for making the needle of Fig. 1 is shown sequentially.

Referring to Fig. 2A step (2) of the above-described process is shown. A plug part 30 for the open end of the bore 14 of a conduit is shown. The plug part 30 is elongated along the vertical longitudinal axis. One end 31 is formed into a male plug adapted to longitudinally mate with the open end 21 of the bore of a conduit, i.e. being of an outside diameter corresponding to the internal diameter of the open end 21 of the bore 14 so that end 31 is a tight fit in open end 21. The opposite end 32 is formed into a pyramidal point. The end surface 31 of the plug part 30 has been cut into the shape of a "V" sectioned valley 33 with its bottom extending across the end surface 31 in the direction B- -B perpendicular to the longitudinal direction. There is an abutment ledge 34 around the part of the plug part 31 closest to the point 32 to limit the extent to which the part 31 can enter the bore 14.

As seen in Fig. 2B the plug part 30 has been mated with the open end of the tubular conduit 12, i.e. step (3).

Fig. 2C shows step (4). Two orifices 15 have been drilled at diametrically opposite positions through the side wall 13 of conduit 12 in a direction converging toward the upstream direction. The line B- -B of the bottom of the valley 33 is aligned parallel to the diameter of the conduit joining the two orifices 15. The downstream perimeter surface 15B of orifice 15 is visible.

Fig 2D shows the rounding of the upstream perimeter surfaces 15A of the orifices 15 using a tool 35, to form the rounded edge 15C.

Fig 2E shows in an exploded view how the drilling of the orifices 15 through the side wall 13 has formed the end surface 16 of the plug end 22 of plug part 20 into side surfaces 17 that converge toward the upstream direction to form the edge 18, and which form part of an overall "saddle" shaped surface, i.e. with surfaces 19 inclined relative to the upstream-downstream direction and generally in planes perpendicular to the planes of the side surfaces 17.

Claims.

1. A hollow needle suitable for passing through a puncturable closure of a container, comprising a tubular conduit defined by a side wall and having an internal bore for the flow of a fluid along the bore in an upstream to downstream direction, the conduit terminating externally at a pointed end, the bore terminating internally at a closed end, at least one orifice through the side wall for the exit of fluid flowing along the bore,

wherein at least one orifice has a perimeter surface through the side wall converging toward the upstream direction so as to direct a flow of fluid passing through the orifice from the bore toward the outside of the needle in a direction which has a component in the downstream direction.

2. A needle according to claim 1 wherein the conduit is cylindrical and there are two orifices with their centres 180° apart on opposite sides of a diameter of the conduit.

3. A needle according to claim 1 or 2 wherein the orifice(s) is(are) elongate in the longitudinal direction of the conduit.

4. A needle according to claim 1, 2 or 3 wherein the total cross sectional area of the one or more orifice is +/- 20% of the cross sectional area of the bore of the conduit.

5. A needle according to any one of the preceding claims wherein the orifice has an upstream perimeter surface through the side wall inclined to converge toward the upstream direction.

6. A needle according to claim 5 wherein the orifice has a downstream perimeter surface through the side wall inclined to converge toward the upstream direction.

7. A needle according to claim 5 or 6 wherein the angle of convergence toward the upstream direction is at an angle of 10-60° with the upstream direction.

8. A needle according to any one of the preceding claims wherein the internal closed end of the bore comprises surfaces that converge toward the upstream direction.

9. A needle according to claim 8 wherein the surfaces converge toward the upstream direction in the form of an edge with its ridge pointing in the upstream direction.

10. A needle according to claim 9 wherein the edge is sharp knife edge between the surfaces of the closed end.

11. A needle according to claim 8, 9 or 10 wherein the angle of convergence is the same as that of one or more of the converging perimeter surfaces of the orifice.

12. A needle according to claim 9, 10 or 11 wherein there are two orifices and the edge formed by the converging surfaces of the internal closed end of the bore is aligned with the line of its ridge perpendicular to the axis between the two orifices.

13. A needle according to any one of claims 9 to 12 wherein the surfaces of the internal closed end of the bore that converge edge extend in the upstream direction at least as far as the upstream perimeter of the orifice.

14. A needle according to any one of claims 9 to 13 wherein the edge is part of a saddle shaped surface.

15. A needle according to any one of the preceding claims wherein the pointed end is a pyramid with three faces.

16. A needle according to any one of the preceding claims wherein the pointed end of the conduit is provided as a separate plug part which can be plugged into the downstream open end of the conduit.

17. A needle according to claim 1 which comprises:

a cylindrical tubular conduit defined by a side wall and having an internal bore for the flow of a fluid along the bore in an upstream to downstream direction, the conduit terminating externally at a pointed end, the bore terminating internally at a closed end, at least one orifice through the side wall for the exit of fluid flowing along the bore,

wherein at least one orifice has upstream and downstream perimeter surfaces through the side wall converging toward the upstream direction at an angle between 10-60° relative to the upstream direction,

the total cross sectional area of the one or more orifice is +/- 20% of the cross sectional area of the bore of the conduit,

and the internal closed end of the bore comprises surfaces that converge toward the upstream direction.

18. A process for making a hollow needle according to any one of the preceding claims comprising the steps of:

(1) providing a tubular conduit defined by a side wall and having an internal bore for the flow of a fluid along the bore in an upstream to downstream direction, the bore having an open end;

(2) providing a plug part for the open end, the plug part having a longitudinal axis and being adapted to longitudinally mate with the open end of the bore and having an end surface and an opposite end,

(3) mating the plug part longitudinally with the bore,

(4) cutting at least one orifice through the side wall in a direction converging toward the upstream direction, and forming the end surface of the plug part into side surfaces that converge toward the upstream direction,

(5) before or after any of steps (1) to (4) forming the opposite end of the plug part into a point.

19. A process according to claim 18 wherein prior to step (3) the end surface of the plug part is formed into the shape of a valley with its bottom extending across the end surface perpendicular to the longitudinal direction.

20. A process according to claim 19 wherein in step (4) the orifice is cut by drilling from a direction parallel to the line of the bottom of the valley.

21. A process for introducing a fluid into a puncturable container comprising the steps of;

(1) inserting the point of a needle as claimed in any one of claims 1-17 into the interior of the container by puncturing the container,

(2) flowing a fluid along the bore of the needle in the upstream to downstream direction,

(3) causing the fluid to exit the needle through the one or more orifice and thereby enter the container, then

(4) withdrawing the needle from the container.

FIG. 1

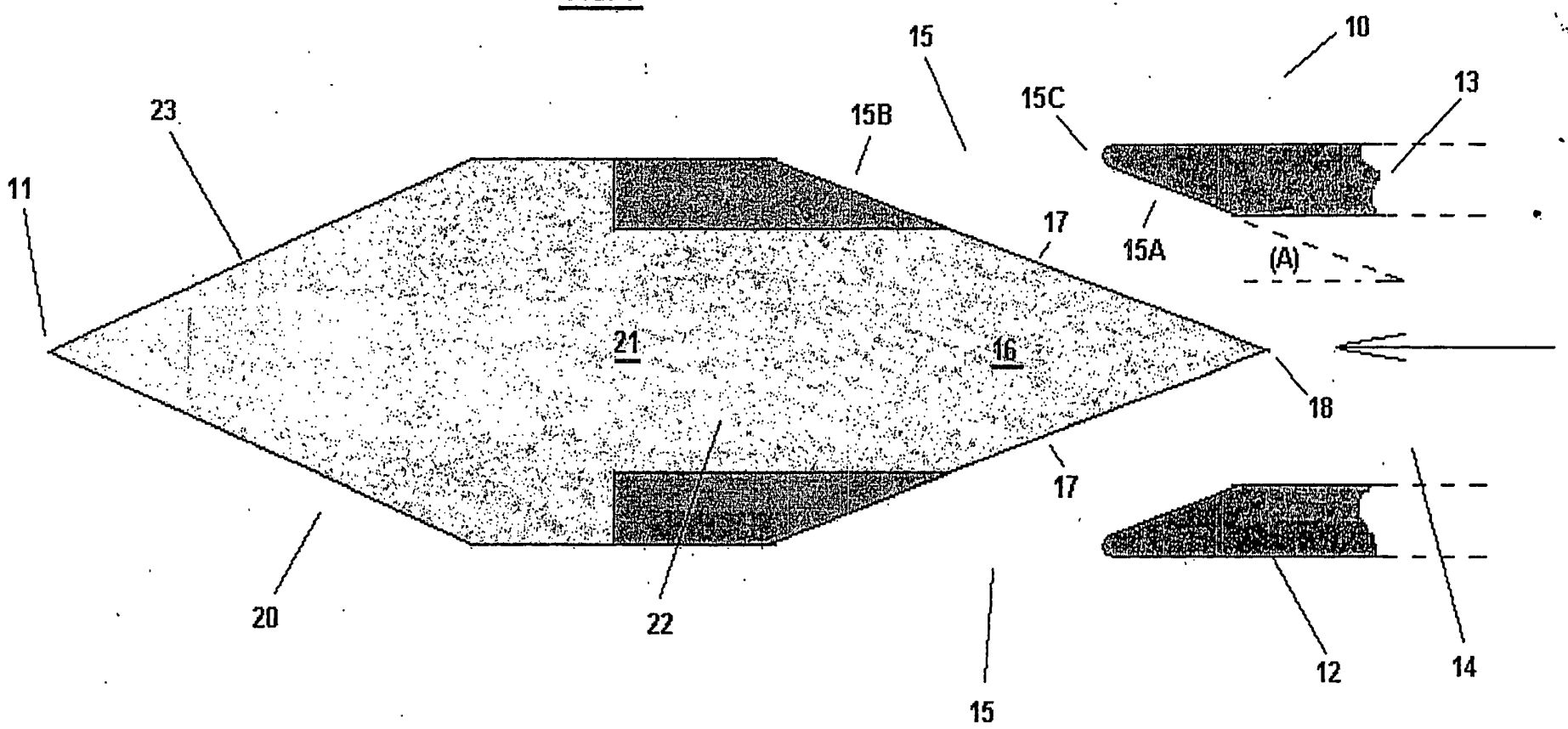

Fig. 2

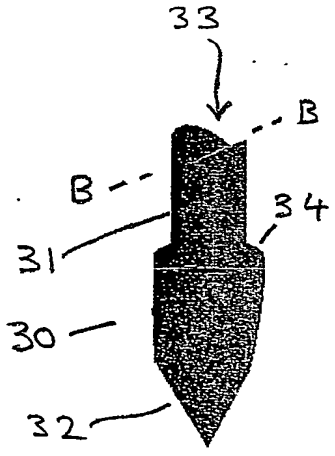

Fig. 2A

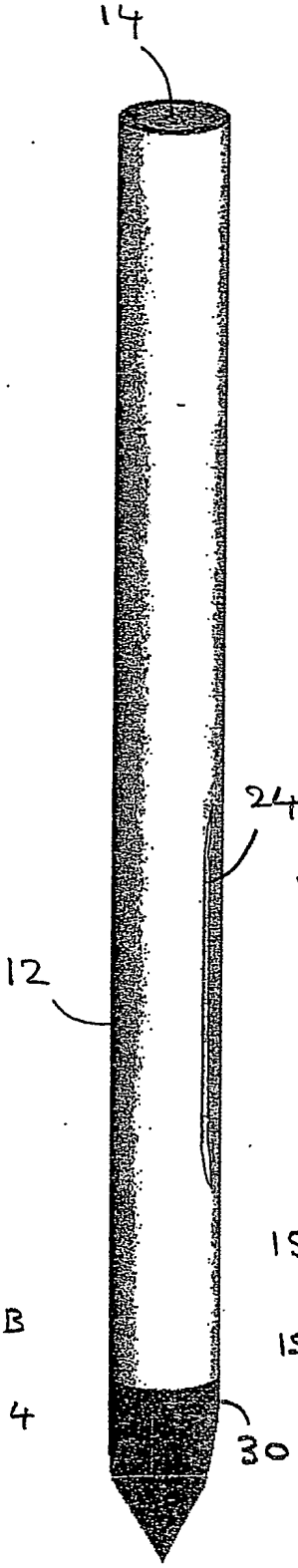

Fig. 2B

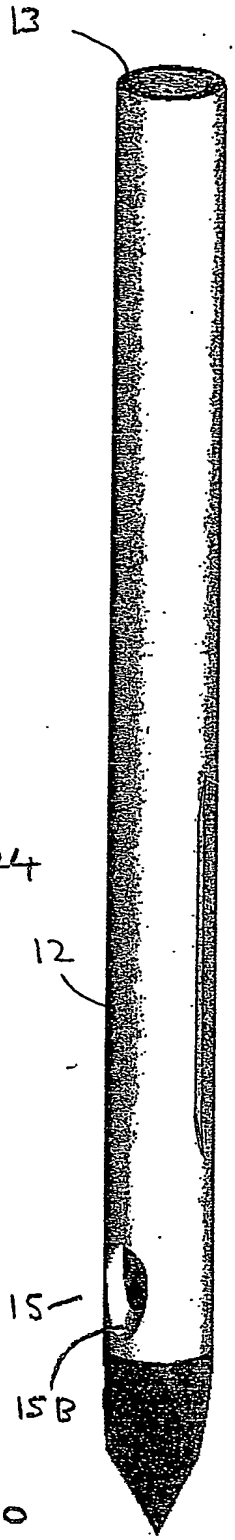

Fig. 2C

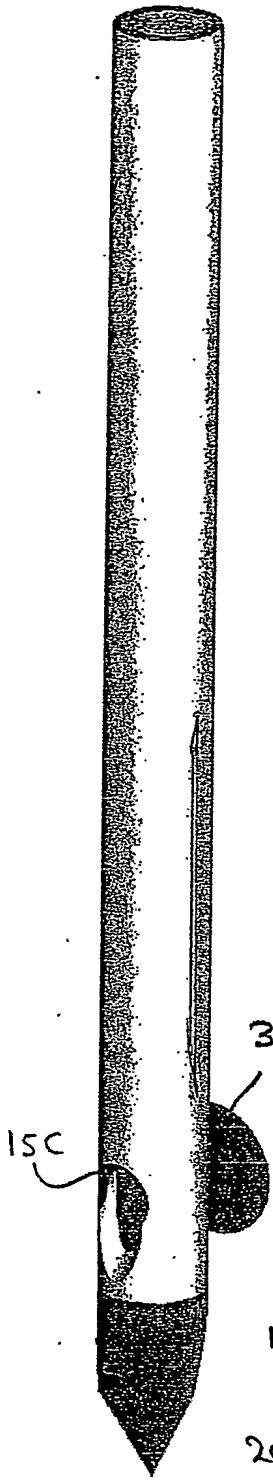

Fig. 2D

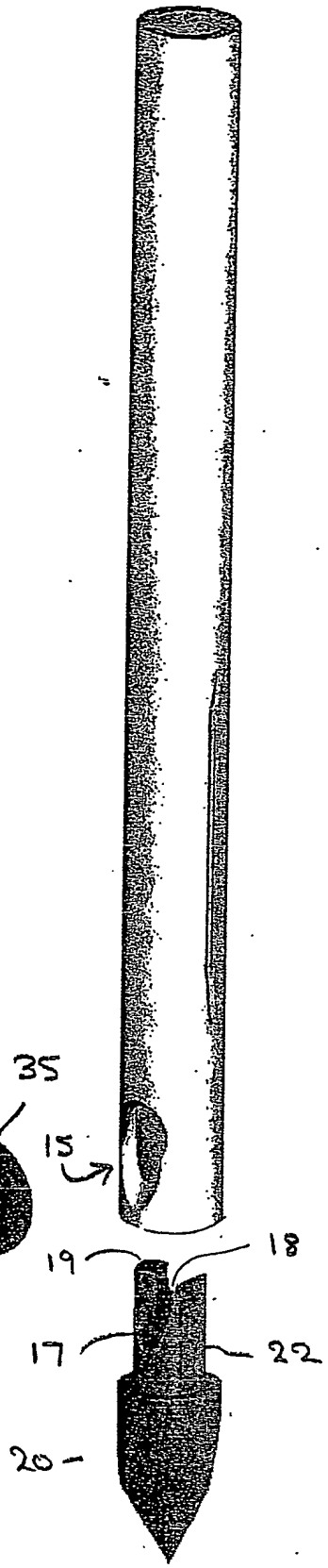

Fig. 2E